DOCUMENT RESUME

ED 170 736 CS 004 849

AUTHOR Brown, Ann L.; Campione, Joseph C.

TITLE Permissible Inferences from the Outcome of Training Studies in Cognitive Development Research. Technical Report No. 127.

INSTITUTION Bolt, Beranek and Newman, Inc., Cambridge, Mass.; Illinois Univ., Urbana. Center for the Study of Reading.

SPONS AGENCY National Inst. of Child Health and Human Development (NIH), Bethesda, Md.
PUB DATE May 79
GRANT HD-00111; HD-05951; HD-06864
NOTE 34p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Objectives; *Cognitive Processes; *Remedial Instruction; Research Criteria; *Research Methodology; *Research Problems; *Training
IDENTIFIERS *Center for the Study of Reading (Illinois)

ABSTRACT

In modal training studies, the comparative groups differ in the use of a particular cognitive process; training to overcome the deficiency is provided for the deficient group only, and their performance is then compared to the standard set by the untrained group. Improvements are necessary in the design of training studies, as are a reconsideration of the types of skills that are the subject of training, and a serious consideration of the relation of the training and transfer tasks to the everyday functioning of the cognitive process under investigation. Specifically, an adequate training program must include the following: careful selection of the cognitive skill to be examined; sensitivity to the actual beginning competence of the learner; stringent analyses of the requirements of the training and transfer task so that transfer failures can be interpreted properly, training in multiple settings to alleviate the problem of welding, direct feedback concerning the effectiveness of the trained skill; and direct instruction concerning the generalization of the trained skills. Until a research program can provide answers to these basic questions, it is premature to conclude that retarded or deprived children and unschooled nonwestern children cannot show flexible effects of training. (DF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED170736

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

CENTER FOR THE STUDY OF READING

Technical Report No. 127

PERMISSIBLE INFERENCES FROM THE OUTCOME OF TRAINING STUDIES IN COGNITIVE DEVELOPMENT RESEARCH

Ann L. Brown and Joseph C. Campione
University of Illinois at Urbana-Champaign

May 1979

University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
50 Moulton Street
Cambridge, Massachusetts 02138

Reprinted from W. S. Hall & M. Cole (Eds.), Quarterly Newsletter of the Institute for Comparative Human Development, 1978, 2, 46-53.

Preparation of this paper was supported by Grants HD 06864, HD 05951, and a Research Career Development Award HD 00111 from the National Institute of Child Health and Human Development.

CS 004 849

Permissible Inferences from the Outcome of

Training Studies in Cognitive Development Research

Our charge in this paper was to provide a statement on the reasons for conducting cognitive training studies, and to comment on the interpretations of the outcome of such research. As extensive reviews of the training literature proliferate (Belmont, 1978; Belmont & Butterfield, 1977; Borkowski & Cavanaugh, 1979; Brown, 1974, 1975, 1977, 1978a; Brown & DeLoache, 1978; Campione & Brown, 1974, 1977, 1978; Butterfield, 1977), the charge would seem to be a simple one. But the task is not simple, mainly because the rationale for conducting such studies, the problems encountered when one does, and the interpretations inspired by the outcomes, all reflect some of the most difficult and controversial issues of comparative research. In short, the central issue is that of individual and group differences in intelligence and the potential for modification of these differences as a result of environmental factors, including direct training and general experience. No student of psychology can be ignorant of the long history of this topic and the controversy, rational and irrational, that it has evoked. To deal with these issues adequately in a limited space would be impossible and, therefore, the interested reader is referred to the list of papers cited above for details of the problem as it concerns the intelligent functioning of retarded individuals. For a treatment of the topic in reference to cross-cultural comparative problems, the reader is referred to any of the recent work by Cole and his associates (e.g., Cole & Scribner, 1975; Cole, Sharp, & Lave, 1976) and to Ginsburg (1977). For a wider treatment of the topic of training and intelligence, the reader is referred to Brown (1978a), Resnick (1976), and to a series of papers given at AERA

in 1978 and reprinted in Intelligence, 1978, (see papers by Campione & Brown, Carroll, Hunt & McLeod, Sternberg, Snow, and Glaser & Pellegrino). Here we will aim at giving a brief statement of the problem, with particular reference to studies of retardation, and highlight the problems of interpretation facing workers in this area.

The Modal Training Study

One reason that a justification and explanation of training studies is needed is due to their very prevalence; this genre of research seems to be a basic enterprise of comparative cognitive psychologists and it is charitable to presume that there is a reason for this uniformity. Consider the modal developmental study (Brown et al., 1978; Brown & DeLoache, 1978). Children of varying age are compared on a single task purported to tap some significant cognitive process. The typical, non-surprising result (if the paper is published) is that the older child outperforms the younger participant. In the better examples of this genre, there is a somewhat more fine-grained analysis of the components of the task enabling the authors to diagnose which processes are failing to function appropriately in the less efficient learner. Other common variants of the situation are those that pit against each other comparative groups that differ not only in age but in terms of putative intelligence level or cultural milieu. The outcome of these endeavors is almost universally a demonstration of poorer performance and/or ineffective processing in the young, the slow, the deprived, the deviant, the non-western, or more recently, the unschooled samples.

The majority of comparative studies rest here; having demonstrated a

developmental effect, some cognitive infirmity of the poorly performing group is inferred, and the research enterprise terminated. An intrepid minority, however, go farther and question the nature of the group differences. Traditionally, the further question has been posed in the form: is the deficiency one of the production or mediation? To restate the problem, the choice presented is between a "deficit" that is readily remediated or one that is not. Remediation can be effected by intervention such as direct instruction, or changing task environments. If either is successful, the original problem is pronounced situationally specific and not due to a stable limitation of the learner. Alternatively, if the deficit appears to be impervious to intervention, it is attributed to a limitation of the learner, one that could be the result of either (or both) inadequate past experience or inherent cognitive potential. Regardless of the etiology, if the deficit is not easily removed, it is taken as an indication of a structural limitation of the organism, perhaps of a permanent nature, or at least diagnostic of current cognitive status (Brown, 1974; Campione & Brown, 1978). A variety of ploys exist that can be used to help distinguish between the oversimplified dichotomy, however, as "cross-situational, cross-cohort, cross-cultural" (Weisz, 1978) comparisons are the exceptions rather than the rule. The major interest of developmental psychologists concerned with the problem has converged on the training study.

The modal training study can be described as follows: The prerequisite is that the comparative groups of interest differ in terms of efficiency in the use of a particular cognitive process. Training designed to overcome

the deficiency is provided for the originally deficient group only, and their performance is then compared to the standard set by the untrained older group. The outcome of such endeavors is encouraging in its stability. If the training is relatively extensive and based on reasonable task and subject analyses, satisfactory improvements in performance occur. In the best examples, retarded children's performance can be improved to the level set by untrained adults (Butterfield, Wambold, & Belmont, 1973). Again, with appropriate training, the effects of the intervention have been found to persist for at least a year (Brown, Campione, & Murphy, 1974; Brown, Campione, & Barclay, 1978). However, with retarded subjects, it is rarely the case that transfer to new variants of a training task is found (Brown, 1978a; Campione & Brown, 1978). A similar statement can be made in regard to transfer of training studies conducted with schooled and unschooled populations in other cultures. A typical interpretation of these findings is that generalization of the effects of training across traditional task boundaries is not a cognitive characteristic of retarded or deprived children in our society and unschooled peoples in non-western society. It is our major contention in this paper that such a strong interpretation is illegitimate, for the data necessary to support it do not exist.

What would be needed before we could arrive at such a strong conclusion? Several initial steps would be necessary: (a) improvements in the design of training studies; (b) a reconsideration of the types of skills that are the subject of training; and (c) a serious consideration of the relation of the training and transfer tasks to the everyday functioning of the cognitive

process under investigation. We will consider these requirements separately.

Basic Requirements of an Adequate Training Study

Earl Butterfield's (1977) detailed analysis of the steps needed to conduct the ideal training study impressed and somewhat daunted investigators in the field. We agree that it is indeed a difficult task to engineer adequate training that could result in practical improvements in performance and in relatively unambiguous theoretical interpretation of the outcome. We would like to add that the situation is even more complex than the Butterfield article would indicate if the aim of training is not only significant enhancement of performance on the initial task but also durability and generality of the benefits of training. To be judged effective, training should improve the overall level of accuracy and the strategies used to attack the task, thereby permitting reasonable attribution of the component process(es) causing the original deficit. But, in addition, for both practical and theoretical reasons, effective training can only be judged as such if it results in long-term improvement in the subject's performance on both the training task and a class of situations that are similar to the training vehicle. To design an adequate training program that would meet these criteria, the following steps would have to be included.

Diagnosis of the Original Difference. Before instruction is even contemplated, preliminary steps must be taken to ensure that the target of training represents a cognitive skill that proves an intransigent problem for the poor performer. To establish that this is, in fact, the case, it would be necessary to examine the spontaneous operation of the skill in more

than one task and in more than one setting (Brown, 1978a). In addition, serious attempts should be made to ensure that the poor performers are not simply serving the necessary role of convenient experimental foils (Brown & DeLoache, 1978; Gelman & Gallistel, 1978) by providing a baseline against which a developmental trend can be established. Quite simply, the young should not be faced with proving their ability on a task ill-designed to measure any competencies they may possess. Sufficient task design and analyses should be undertaken so that the particular rules or strategies used by the young child can be detected, so that we do not end up with a total lack of information concerning what it is that the younger subjects are doing when they fail to perform in an "appropriate" manner. Additional refinements that would be nice, if not absolutely necessary, would be that starting, intermediate, and end state levels of competence could be identified so that instructional routines could be tailored to fit the diagnosis (Brown & DeLoache, 1978).

One last distinction concerning the identification of the initial learning problem concerns the type of knowledge that the child may lack. We refer here to the tenuous separation of task-specific knowledge and the general control of that knowledge. Ginsburg (1977) distinguished between the learning of principles and the learning of strategies. For example, one can acquire either the principle or the practice of addition or both. Knowing that you need to add is the principle, but knowing how to employ a counting routine effectively would be the strategy. We have made similar distinctions between the general and specific results of training, a

distinction that has been placed in the context of the memory-metamemory literature (Brown, 1978a). For example, in a traditional memory task, one can make the distinction between knowing that one should introduce an active strategy (the principles of being strategic or engaging in self-regulation) and knowing that a particular variant of a rehearsal strategy would be the most helpful. Assessing differences in these types of knowledge would have important implications for what kind of training might be designed. For example, faced with a task where rehearsal is required, the nonrehearser could be in one of several states of ignorance. He could lack the principle that he must be strategic at all, or he could lack the principle that he should rehearse. Even if he has been known to rehearse in the past, he may lack sufficient mastery over this task appropriate strategy for a variety of reasons, including: not knowing how to rehearse effectively, not recognizing the new task as one that demands rehearsal, or not knowing how to modify his existing strategy to meet the changed surface structure of the new task. Simply designating a subject in any one of these dilemmas a non-rehearser is an inadequate diagnosis of his starting state of knowledge. A more fine-grained initial subject analysis would greatly inform the subsequent task analysis undertaken to design training. A very different form of training would be prescribed for subjects suffering from the varying kinds of ignorance.

Training. The design of a training routine should be based on adequate task, situation, and subject analyses, a point that has been made many times and a practice that has been shown to be successful in a variety of domains

(Brown, 1970, 1974; Butterfield et al., 1973; Campione & Brown, 1974; Gelman & Gallistel, 1978). This literature has been adequately reviewed, and we have no space to reiterate it here. One point about training studies that has not received attention, however, is that instruction is rarely provided for the originally adequate. Given that the aim is often a practical one of enhancing the performance of the inefficient, the common practice of training only those in need is obviously economically defensible. But there are interesting theoretical questions that remain unanswered by this procedure, and, the simple expedient of also providing training for a subset of the originally competent serves a useful function. Sometimes the tactic establishes convincingly the exact nature of the original problem. For example, Brown, Campione, and Gilliard (1974) attributed the superiority of older children on a judgment of recency task to their ability to capitalize on the presence of relevant background cues that could serve as temporal anchor points. Training an anchor-cue utilization strategy completely removed the developmental effect: trained subjects, young and old alike, performed identically, whereas untrained older children had out-performed untrained younger children. In other cases, however, individual or group differences are of the same magnitude before or after intervention (Huttenlocher & Burke, 1976; Lyons, 1977). We believe there are nontrivial theoretical reasons to expect these differences pertaining to the nature of the strategic components of the tasks and the concept of individual differences in intelligence (Campione & Brown, 1978).

Another training tactic that can clarify some problems of interpretation

is one that has been employed successfully by two of the major training programs (Brown, Campione, Bray, & Wilcox, 1973; Belmont & Butterfield, 1977). In order to pin down the culprit responsible for an initial performance decrement, one both prevents the originally efficient from engaging in the activity putatively responsible for their effectiveness and induces the poor performers to adopt the appropriate activity. If these manipulations result in comparable patterns of performance, one can be more confident that the original diagnosis was correct.

Maintenance and Generalization. Given that one can induce adequate performance on the training task, it is then desirable to show that the benefits of the instruction are durable and generalizable. By durable we mean that the effects of training will persist in the absence of intrusive aids, when minor changes in surface structure (e.g., stimulus materials) take place and over significant time intervals. But more than that, successful training must result in appropriate generalization, i.e., transfer to tasks where the new behavior would obviously be helpful but not to situations where its use would be less than optimal. Generalization involves more than just the use of a trained behavior, it involves discrimination of appropriate and inappropriate settings: the learner must know where and how to transfer and when not to (Brown, 1978; Campione & Brown, 1974, 1978; Ginsburg, 1977).

Given the proliferation of evidence suggesting that such flexible generalization of training is rarely the outcome of cognitive training studies, are we justified in concluding, as many have, that failure to generalize is a defining feature of the cognitive apparatus of retarded children? We think

not, if only because the appropriate tests have yet to be made. Despite the great deal of interest, there has been a dearth of informed experimentation or observation of the conditions that would promote flexible learning. However, we do have enough experience to provide guidelines that we believe would result in appropriate transfer.

Let us begin with the simplest form of transfer failure, the situation where the child does not even maintain the new behavior unless specifically prompted to do so (Brown, 1978; Brown, Campione, & Barclay, 1978). One explanation of this finding is that the child simply does not appreciate that the trained strategy improved performance. If it is true that young children are totally unaware of the utility of a strategy, why should they benefit from instruction? If trained to rehearse, they will rehearse only if the situation remains unchanged and they receive continual reminders. But why should they be expected to maintain the behavior, let alone use the new skills insightfully, if the reason for the activity was never made clear? Young children will maintain the effects of training, however, if they can be made aware of the usefulness of the trained strategy (Kennedy & Miller, 1976), and a clear first step in designing training studies should be in include explicit feedback of the new behavior's effectiveness.

The aim of training is to achieve not only maintenance but generalization. A major impediment was pointed out by the Soviet psychologist Shif (1969), who identified a consistent problem with training retarded children, i.e., the effect of training seemed to be "welded" to the situation in which it was provided. Given that there are ample examples of such welding in the

literature, we suggest that direct attempts to overcome the problem should be initiated. Training in multiple settings appears to be the answer. If the learner is instructed in the use of a strategy in more than one appropriate setting, this should reduce the tendency for strict situationally-specific learning to occur (Brown, 1974, 1978; Campione & Brown, 1974). There is some preliminary evidence that the tactic will be successful (Belmont, Butterfield, & Borkowski, 1978).

The very young child in a training study is often unaware that the separate phases of the experiment are indeed related (Bullock & Gelman, 1977; Campione, 1973). It is not surprising, therefore, that the utility of a prior solution or strategy to a new variant of the training task does not occur to them spontaneously. But, if the aim of training is flexible generalization, then it seems reasonable to include in the training package direct instructions concerning generalization. For example, one could tell the child that the trained behavior could help him on a variety of similar tasks and that the trick is to know which ones. The child could then be exposed to a variety of prototypic tasks (those on which experienced users of the strategy would always attempt to use it) and the utility of the strategy in such situations explained and demonstrated. At that point, inappropriate tasks could be considered, and the reason why the trained behavior would not be helpful could be pointed out. Finally, the child could be presented with a generalization test containing new prototypic and inappropriate tasks and his intelligent/unintelligent application of the strategy examined. As far as we know, this procedure has not been attempted, but we

are currently investigating the feasibility of such direct generalization training which incorporates the suggestions made above, together with direct instruction in modifying an overlearned strategy to fit changes in the exact specifications of the new tasks.

Another crucial decision for those who would undertake training studies is the choice of both the training and transfer tasks. It is obviously necessary that the tasks should be related in such a way that efficient users of the cognitive skill in question would spontaneously adopt it on both occasions (Brown, 1978; Brown, Campione, & Murphy, 1977). The tasks must evoke the same underlying cognitive process but differ sufficiently in surface structure to provide a reasonable test of generalization. Many of the "successful" training studies have employed transfer tests that vary so little from the training vehicle that one can dispute whether it really is generalization they have achieved or simply maintenance. The investigator must justify the distinction between maintenance and generalization on at least practical, and preferably theoretical, grounds.

An additional requirement is that the investigator be able to distinguish between different potential causes of transfer failures, for a failure to perform adequately on transfer could be due to the trainees' inability to see the relation of the trained behavior to the new task, the usual interpretation, or to his inability to execute some other component of the transfer task which neither they nor the investigator fully appreciate. In an early series of studies addressed at identifying transfer mechanisms in a discrimination learning paradigm (Campione & Brown, 1974), we discussed a number of

possible reasons for failing to observe transfer. One, termed the interaction of components hypothesis, was based on the view that subjects might in fact generalize the trained component to a transfer task but be unable to demonstrate the generalization due to a weakness with some other component of the transfer task. As a simple example, an attempt to generalize a trained rehearsal strategy to a new task would be hidden if the subjects could not come up with names or labels for the stimuli. Unless the experimenter is aware of these additional components, it is impossible to interpret transfer failures. In the 1974 paper, we also provide some data consonant with the interaction of components hypothesis. Therefore, our final prescription for designing training is that sufficient task analyses be instituted to enable an unambiguous attribution of failures to the proper cause.

In summary, we have suggested that the basic requirements of an adequate training program must include: 1) careful selection of the cognitive skill to be examined; 2) sensitivity to the actual beginning competence of the learner; 3) stringent analyses of the requirements of the training and transfer task so that transfer failures may be interpreted properly; 4) training in multiple settings to alleviate the problem of welding; 5) direct feedback concerning the effectiveness of the trained skill; and 6) direct instruction concerning the generalization of the trained skills. Until a research program can provide answers to these basic questions, it would be premature to conclude that retarded children can, under no circumstances, show flexible effects of training.

Reconsideration of the Skills Trained

Specific versus General Skills. Given the impressive evidence of young children's general problems with self regulation and control of their goal-directed activities (Brown, 1975, 1978a; Brown & DeLoache, 1978; Meichenbaum, 1977; Mischel & Patterson, 1976), and the less than optimistic forecast concerning the benefits of training specific cognitive strategies, we believe that it would be judicious to re-think the type of skills that are the subject of intensive training. If it is true that young children in general, and slow-learning children in particular, experience major problems when required to orchestrate and regulate their own attempts at strategic intervention (Brown, 1978a; Brown & DeLoache, 1978; Campione & Brown, 1977, 1978), then an alternative approach to training specific mnemonics would be to train the metacognitive skills that provide the most pronounced difficulties for the immature learner (Brown, 1978a; Brown, Campione, & Murphy, 1977). Metacognitive skills, such as checking, planning, asking questions, self-testing, and monitoring ongoing attempts to solve problems are characteristically lacking in retarded children's laboratory learning performance (Brown, 1978a). In addition, these skills are, by their very nature, general ones in that they apply in a wide variety of problem solving situations. Furthermore, they are the very control processes implicated in breakdowns of effective transfer of training (Brown, 1974, 1978; Campione & Brown, 1974, 1977, 1978). As such, the rationale for directing training attempts at metacognitive skills is persuasive.

There is another reason why training attempts directed at general skills might be more likely to result in transfer. One problem with specific skills is that they are just that--specific to a very small class of situations. For learners to generalize the effects of instruction in the use of specific routines, they would have to be able to discriminate the situations in which the routine would be appropriate from those in which it would not. Adequate generalization requires both extended use in novel situations and decisions not to use the trained routines in other situations where it would not be beneficial (Brown, 1978a; Campione & Brown, 1974, 1978). In the case of truly general skills, this discrimination should not be necessary, as the skill or routine could simply be used in a whole battery of problem solving situations without regard to any subtle analysis of the task being attempted. In this sense, "general metacognitive skills" might be regarded as easy ones to instruct, or at least the most likely to lead to transfer across task boundaries; and it makes sense to begin training with skills which are the simplest.

The types of general problem solving skills we are particularly interested in would be the ability to stop and think before attempting a problem, to ask questions of oneself and others to determine if one recognizes the problem, to check solutions against reality by asking not "is it right, but is it reasonable," to monitor attempts to learn to see if they are working or are worth the effort (Brown, 1978a, 1978b). There are serious problems associated with this position, for it is certainly easier to suggest that training should be aimed at showing children "how to organize their knowledge"

and "how to solve problems," etc. (Norman, Gentner, & Stevens, 1976) than it is to instantiate these suggestions in concrete training programs. But, in view of the dismal failure, so far, to induce generalization in slow-learning children, an attempt to address the problem of training general skills seems to be timely.

We have some preliminary evidence that training such general skills will be effective in producing transfer, both from our own laboratory and from a consideration of behavior modifications programs aimed at teaching self-instructional routines (Meichenbaum, 1977). The task presented to retarded adolescents was one of estimating their readiness to be tested for rote recall of a list of picture names. We trained a stop-test-and-study routine where the test element was anticipation. Trained students performed more effectively and maintained their superiority over a one-year retention interval. They also transferred the trained routine to a task demanding the same general tactic but differing in surface structure, i.e., a prose recall task where the subject was required to retain the gist of the passage. In comparison to a pair of control groups, the trained students were observed to engage in more overt self-checking behavior, took more time studying, recalled more idea units from the passage, and, further, their recall was more clearly related to the thematic importance of the constituent idea units, a pattern characteristic of developmentally more advanced students (Brown, Campione, & Barclay, 1978).

Thus, our major success to date came when we turned to a very simple self-testing routine. We are currently examining the generality of the

effects of teaching children to self-interrogate when faced with a certain class of problems (instructions, math problems, a laboratory task, etc.). The type of self-interrogation which we think might work is to provide the child with a routine set of questions to ask himself before proceeding, e.g., (a) stop and think! (b) do I know what to do (i.e., understand the instructions, both explicit and implicit)? (c) is there anything more I need to know before I can begin? and (d) is there anything I already know that will help me (i.e., is this problem in any way like one I have done before)? It is with self-instructional routines such as these that those engaged in behavior modification training and classroom management have achieved their major success in inculcating generalized improvement (Meichenbaum, 1977; Stokes & Baer, 1977).

Transfer Appropriate Processing. We would like to point out that the preceding discussion applies principally to situations where the child must acquire and transfer mechanisms of learning that lead to rote recall, or at least gist recall of material. But this is not the only form of learning, for a fundamental form of learning can be described as "coming to understand something that one had not previously understood" (Bransford & Nitsch, 1978; Brown, 1978b). Bransford's concept of transfer appropriate processing has much in common with a major tenet of Soviet psychology--that activities are purposive and goal directed. An appropriate learning situation therefore is one that is compatible with the desired end state, and one cannot decide upon appropriate training unless one considers the question "appropriate for what end?" (Brown, 1978b). Traditionally, learning studies have relied

almost exclusively upon accuracy of memory in assessing the success of learning, but the practice can lead one to neglect some important aspects of learning that are necessary for valuable kinds of transfer. Knowledge in a form that permits optimal memory need not be in an optimal form to be used to understand a novel input. For example, Nitsch (1978) investigated the effectiveness of several study activities for helping subjects learn a set of new concepts. The task consisted of having subjects learn a definition and several examples of a number of concepts. Two of the several study activities were: memorization of the definitions, or identifying the list of examples. While the group attained equivalent levels of learning as assessed by a memory test of the original examples, they differed reliably at identifying novel examples of the concepts which were introduced in the transfer phase. Thus, in the former case, the study activities appear equivalent, whereas in the latter case, a clear advantage accrues to the condition where identifying examples was the main activity in the study period. These studies, and others from Bransford's laboratory, illustrate that the optimal learning situation can only be determined relative to the uses to which the acquired knowledge will subsequently be put. Investigation of the compatibility of the learning situation for a variety of subsequent uses would go a long way toward clarifying our knowledge about appropriate training.

Relations of Trained Skills to Real-Life Experience

As a result of both our success and failure in attempting to train retarded children to perform more effectively on common problem-solving tasks

we suggest that the types of cognitive activities which are most suitable for intensive intervention should have certain properties: (a) they should be applicable in a wide range of situations, (b) they should readily be seen by the child to be reasonable activities that work, (c) they should have some counterpart in real-life experience, and (d) their component processes should be well understood so that effective training techniques can be devised. In this final section we would like to address (c) the problem of real-life counterparts. This discussion will be brief because we have run out of space and because detailed discussions of this topic have been featured in recent articles (Cole, Hood, & McDermott, 1978; Ginsburg, 1977; Rogoff, 1978). Here we would just like to confirm the complexity of the problem as illustrated by these prior papers and to stress that the problem of ecological validity is rarely considered in discussion of the cognitive performance of retarded children (Brown, 1978a).

The issue can be addressed at two levels. First there is the problem of the cultural context of learning and the design of cognitive tasks. Consider an example, Lave (1977) examined transfer of arithmetic and measurement skills by Liberian tailors with varying amounts of tailoring experience and varying degrees of formal education. Transfer problems were formally equivalent in terms of the underlying computational requirements but were presented in a surface format that was appropriate either to the familiar context of tailoring or to the context of formal education. Experience was significantly related to transfer efficiency. Tailoring experience led to success across tailoring problems whereas experience with formal

education led to transfer across traditional school problems. Transfer operates within limited contexts and depends on experience and task familiarity. This kind of detailed attention to the conditions promoting generalization has rarely been lavished on the disadvantaged child in our society. But in order to fully understand the retarded student's general failure to be strategic, or transfer learning, on tasks that represent formal educational enterprises, it is necessary for us to consider the processes of learning within realms with which they are experienced (Brown, 1978a).

This problem brings us face to face with the whole issue of ecological validity and the comparative research enterprise (Cole, Hood, & McDermott, 1978) and a level of complexity above the mere problem of providing familiar contexts of learning. As Cole et al. point out there are serious problems with the assumption that what is important concerning cognitive skills can be identified in the laboratory and then observed in real life situations where a familiar variant of the skill operates naturally. It is entirely possible that laboratory tasks are related in only trivial ways to the common exercises of intelligent adaptation. If so, one would need to examine the learning process in cultural manifestation with which cognitive psychologists themselves are unfamiliar, where the very identification and classification of learning activities would prove troublesome and measurement problems would be severe. Yet in spite of the complexity of the problem, an awareness of these issues must lead us to consider learning in natural contexts as well as laboratory settings and thereby inform theories of learning in ways that would be precluded by a total reliance on standardized tests and laboratory tasks.

References

Belmont, J. M. Individual difference in memory: The case of normal and retarded development. In M. Gruneberg & P. Morris (Eds.), Aspects of memory. London: Methuen, 1978.

Belmont, J. M., & Butterfield, E. C. The instruction approach to developmental cognitive research. In R. V. Kail, Jr., & J. W. Hagen (Eds.), Perspectives on the development of memory and cognition. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Belmont, J. M., Butterfield, E. C., & Borkowski, J. G. Training retarded persons to generalize memorization across memory tasks. In M. M. Gruneberg, P. E. Morris, & R. N. Sykes (Eds.), Practical aspects of memory. London: Academic Press, 1978.

Borkowski, J. G., & Cavanaugh, J. C. Maintenance and generalization of skills and strategies by the retarded. To appear in N. R. Ellis (Ed.), Handbook of mental deficiency: Psychological theory and research, Second edition. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1979.

Bransford, J. D., & Nitsch, K. E. Coming to understand things that we could not previously understand. Address presented at NICHD conference on "Implications of basic speech and language research to the school and clinic," Bethesda, May, 1976.

Brown, A. L. Subject and experimental variables in the oddity learning of normal and retarded children. American Journal of Mental Deficiency, 1970, 75, 142-151.

Brown, A. L. The role of strategic behavior in retardate memory. In N. R.

Ellis (Ed.), International review of research in mental retardation, Vol. 7. New York: Academic Press, 1974.

Brown, A. L. The development of memory: Knowing, knowing about knowing, and knowing how to know. In H. W. Reese (Ed.), Advances in child development and behavior, Vol. 10. New York: Academic Press, 1975.

Brown, A. L. Development, schooling and the acquisition of knowledge about knowledge. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), Schooling and the acquisition of knowledge. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Brown, A. L. Knowing when, where, and how to remember: A problem of metacognition. In R. Glaser (Ed.), Advances in instructional psychology, Vol. 1. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978. (a)

Brown, A. L. Theories of memory and the problems of development: Activity, growth, and knowledge. In L. Cermak, & F. I. M. Craik (Eds.), Levels of processing in memory. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978. (b)

Brown, A. L., Campione, J. C., & Barclay, C. R. Training self-checking routines for estimating test readiness: Generalization from list learning to prose recall. Technical report, Center for the Study of Reading, University of Illinois, 1978.

Brown, A. L., Campione, J. C., Bray, N. W., & Wilcox, B. L. Keeping track of changing variables: Effects of rehearsal training and rehearsal prevention in normal and retarded adolescents. Journal of Experimental Psychology, 1973, 101, 123-131.

Brown, A. L., Campione, J. C., & Gilliard, D. M. Recency judgments in children: A production deficiency in the use of redundant background cues. Developmental Psychology, 1974, 10, 303.

Brown, A. L., Campione, J. C., & Murphy, M. D. Keeping track of changing variables: Long-term retention of a trained rehearsal strategy by retarded adolescents. American Journal of Mental Deficiency, 1974, 78, 446-453.

Brown, A. L., Campione, J. C., & Murphy, M. D. Maintenance and generalization of trained metamnemonic awareness in educable retarded children. Journal of Experimental Child Psychology, 1977, 24, 191-211.

Brown, A. L., & DeLoache, J. S. Skills, plans and self-regulation. In R. Siegler (Ed.), Carnegie-Mellon symposium on cognition. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.

Bullock, M., & Gelman, R. Numerical reasoning in young children: The ordering principle. Child Development, 1977, 48, 427-434.

Butterfield, E. C. On studying cognitive development. In G. P. Sackett (Ed.), Observing behavior. Vol. 1: Theory and application in mental retardation. Baltimore: University Park Press, 1977.

Butterfield, E. C., Wambold, C., & Belmont, J. M. On the theory and practice of improving short-term memory. American Journal of Mental Deficiency, 1973, 77, 654-669.

Campione, J. C. The generality of transfer: Effects of age and similarity of training and transfer tasks. Journal of Experimental Child Psychology, 1973, 15, 407-418.

Campione, J. C., & Brown, A. L. The effects of contextual changes and degree of component mastery on transfer of training. In H. W. Reese (Ed.), Advances in child development and behavior, Vol. 9. New York: Academic Press, 1974.

Campione, J. C., & Brown, A. L. Memory and metamemory development in educable retarded children. In R. V. Kail, Jr., & J. W. Hagen (Eds.), Perspectives on the development of memory and cognition. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Campione, J. C., & Brown, A. L. Toward a theory of intelligence: Contributions from research with retarded children. Intelligence, 1978, in press.

Cole, M., Hood, L., & McDermott, R. P. Concepts of ecological validity: Their differing implications for comparative cognitive research. In W. S. Hall, & M. Cole (Eds.), The quarterly newsletter of the Institute for Comparative Human Development, 1978, 2, 34-37.

Cole, M., & Scribner, S. Theorizing about socialization and cognition. Ethos, 1975, 3, 250-268.

Cole, M., Sharp, D. W., & Lave, C. The cognitive consequences of education: Some empirical evidence and theoretical misgivings. Urban Review, 1976, 9, 218-233.

Gelman, R., & Gallistel, C. R. The young child's understanding of number: A window on early cognitive development. Harvard University Press, 1978.

Ginsburg, H. Some problems in the study of schooling and cognition. In W. S. Hall, & M. Cole (Eds.), The quarterly newsletter of the Institute for Comparative Human Development, 1977, 1, 7-10.

Huttenlocher, J., & Burke, D. Why does memory span increase with age? Cognitive Psychology, 1976, 8, 1-31.

Kennedy, B. A., & Miller, D. J. Persistent use of verbal rehearsal as a function of information about its value. Child Development, 1976, 47, 566-569.

Lave, J. Tailor-made experiments and evaluating the intellectual consequences of Apprenticeship training. In Hall & Cole, Child Development, 1977, 1, 1-3.

Lyons, D. R. Individual differences in immediate serial recall: A matter of mnemonics? Cognitive Psychology, 1977, 9, 403-411.

Meichenbaum, D. Cognitive-behavior modification: An integrative approach. New York: Plenum, 1977.

Mischel, W., & Patterson, C. J. Substantive and structural elements of effective plans for self-control. Journal of Personality and Social Psychology, 1976, 34, 942-950.

Nitsch, K. E. Structuring decontextualized forms of knowledge. Unpublished Ph.D. Thesis, Vanderbilt University, 1978.

Norman, D. A., Gentner, D. R., & Stevens, A. L. Comments on learning schemata and memory representation. In D. Klahr (Ed.), Cognition and instruction. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1976.

Resnick, L. B. (Ed.) The nature of intelligence. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1976.

Rogoff, B. B. Spot Observation: An introduction and examination. In Hall & Cole, Child Development, 1978, 2, 21-26.

Shif, Z. I. Development of children in schools for the mentally retarded. In M. Cole, & I. Maltzman (Eds.), A handbook of contemporary Soviet psychology. New York: Basic Books, 1969. Pp. 326-353.

Stokes, T. F., & Baer, D. M. An implicit technology of generalization. Journal of Applied Behavior Analysis, 1977, 10, 349-367.

Weisz, J. R. Transcontextual validity in developmental research. Child Development, 1978, 49, 1-12.

CENTER FOR THE STUDY OF READING

READING EDUCATION REPORTS

No. 1: Durkin, D. *Comprehension Instruction—Where are You?*, October 1977. (ERIC Document Reproduction Service No. ED 146 566, 14p., HC-$1.67, MF-$.83)

No. 2: Asher, S. R. *Sex Differences in Reading Achievement*, October 1977. (ERIC Document Reproduction Service No. ED 145 567, 30p., HC-$2.00, MF-$.83)

No. 3: Adams, M. J., Anderson, R. C., & Durkin, D. *Beginning Reading: Theory and Practice*, November 1977. (ERIC Document Reproduction Service No. ED 151 722, 15p., HC-$1.67, MF-$.83)

No. 4: Jenkins, J. R., & Pany, D. *Teaching Reading Comprehension in the Middle Grades*, January 1978. (ERIC Document Reproduction Service No. ED 151 756, 36p., HC-$2.06, MF-$.83)

No. 5: Bruce, B. *What Makes a Good Story?*, June 1978. (ERIC Document Reproduction Service No. ED 158 222, 16p., HC-$1.67, MF-$.83)

No. 6: Anderson, T. H. *Another Look at the Self-Questioning Study Technique*, September 1978.

No. 7: Pearson, P. D., & Kamil, M. L. *Basic Processes and Instructional Practices in Teaching Reading*, December 1978.

CENTER FOR THE STUDY OF READING

TECHNICAL REPORTS

No. 1: Halff, H. M. *Graphical Evaluation of Hierarchical Clustering Schemes,* October 1975. (ERIC Document Reproduction Service No. ED 134 926, 11p., HC-$1.67, MF-$.83)

No. 2: Spiro, R. J. *Inferential Reconstruction in Memory for Connected Discourse,* October 1975. (ERIC Document Reproduction Service No. ED 136 187, 81p., HC-$4.67, MF-$.83)

No. 3: Goetz, E. T. *Sentences in Lists and in Connected Discourse,* November 1975. (ERIC Document Reproduction Service No. ED 134 927, 75p., HC-$3.50, MF-$.83)

No. 4: Alessi, S. M., Anderson, T. H., & Biddle, W. B. *Hardware and Software Considerations in Computer Based Course Management,* November 1975. (ERIC Document Reproduction Service No. ED 134 928, 21p., HC-$1.67, MF-$.83)

No. 5: Schallert, D. L. *Improving Memory for Prose: The Relationship between Depth of Processing and Context,* November 1975. (ERIC Document Reproduction Service No. ED 134 929, 37p., HC-$2.06, MF-$.83)

No. 6: Anderson, R. C., Goetz, E. T., Pichert, J. W., & Halff, H. M. *Two Faces of the Conceptual Peg Hypothesis,* January 1976. (ERIC Document Reproduction Service No. ED 134 930, 29p., HC-$2.06, MF-$.83)

No. 7: Ortony, A. *Names, Descriptions, and Pragmatics,* February 1976. (ERIC Document Reproduction Service No. ED 134 931, 25p., HC-$1.67, MF-$.83)

No. 8: Mason, J. M. *Questioning the Notion of Independent Processing Stages in Reading,* February 1976. (*Journal of Educational Psychology,* 1977, *69,* 288-297)

No. 9: Siegel, M. A. *Teacher Behaviors and Curriculum Packages: Implications for Research and Teacher Education,* April 1976. (ERIC Document Reproduction Service No. ED 134 932, 42p., HC-$2.06, MF-$.83)

No. 10: Anderson, R. C., Pichert, J. W., Goetz, E. T., Schallert, D. L., Stevens, K. C., & Trollip, S. R. *Instantiation of General Terms,* March 1976. (ERIC Document Reproduction Service No. ED 134 933, 30p., HC-$2.06, MF-$.83)

No. 11: Armbruster, B. B. *Learning Principles from Prose: A Cognitive Approach Based on Schema Theory,* July 1976. (ERIC Document Reproduction Service No. ED 134 934, 48p., HC-$2.06, MF-$.83)

No. 12: Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. T. *Frameworks for Comprehending Discourse,* July 1976. (ERIC Document Reproduction Service No. ED 134 935, 33p., HC-$2.06, MF-$.83)

No. 13: Rubin, A. D., Bruce, B. C., & Brown, J. S. *A Process-Oriented Language for Describing Aspects of Reading Comprehension,* November 1976. (ERIC Document Reproduction Service No. ED 136 188, 41p., HC-$2.06, MF-$.83)

No. 14: Pichert, J. W., & Anderson, R. C. *Taking Different Perspectives on a Story,* November 1976. (ERIC Document Reproduction Service No. ED 134 936, 30p., HC-$2.06, MF-$.83)

No. 15: Schwartz, R. M. *Strategic Processes in Beginning Reading,* November 1976. (ERIC Document Reproduction Service No. ED 134 937, 19p., HC-$1.67, MF-$.83)

No. 16: Jenkins, J. R., & Pany, D. *Curriculum Biases in Reading Achievement Tests,* November 1976. (ERIC Document Reproduction Service No. ED 134 938, 24p., HC-$1.67, MF-$.83)

No. 17: Asher, S. R., Hymel, S., & Wigfield, A. *Children's Comprehension of High- and Low-Interest Material and a Comparison of Two Cloze Scoring Methods,* November 1976. (ERIC Document Reproduction Service No. ED 134 939, 32p., HC-$2.06, MF-$.83)

No. 18: Brown, A. L., Smiley, S. S., Day, J. D., Townsend, M. A. R., & Lawton, S. C. *Intrusion of a Thematic Idea in Children's Comprehension and Retention of Stories,* December 1976. (ERIC Document Reproduction Service No. ED 136 189, 39p., HC-$2.06, MF-$.83)

No. 19: Kleiman, G. M. *The Prelinguistic Cognitive Basis of Children's Communicative Intentions,* February 1977. (ERIC Document Reproduction Service No. ED 134 940, 51p., HC-$3.50, MF-$.83)

No. 20: Kleiman, G. M. *The Effect of Previous Context on Reading Individual Words,* February 1977. (ERIC Document Reproduction Service No. ED 134 941, 76p., HC-$4.67, MF-$.83)

No. 21: Kane, J. H., & Anderson, R. C. *Depth of Processing and Interference Effects in the Learning and Remembering of Sentences,* February 1977. (ERIC Document Reproduction Service No. ED 134 942, 29p., HC-$2.06, MF-$.83)

No. 22: Brown, A. L., & Campione, J. C. *Memory Strategies in Learning: Training Children to Study Strategically,* March 1977. (ERIC Document Reproduction Service No. ED 136 234, 54p., HC-$3.50, MF-$.83)

No. 23: Smiley, S. S., Oakley, D. D., Worthen, D., Campione, J. C., & Brown, A. L. *Recall of Thematically Relevant Material by Adolescent Good and Poor Readers as a Function of Written Versus Oral Presentation,* March 1977. (ERIC Document Reproduction Service No. ED 136 235, 23p., HC-$1.67, MF$-.83)

No. 24: Anderson, R. C., Spiro, R. J., & Anderson, M. C. *Schemata as Scaffolding for the Representation of Information in Connected Discourse,* March 1977. (ERIC Document Reproduction Service No. ED 136 236, 18p., HC-$1.67, MF-$.83)

No. 25: Pany, D., & Jenkins, J. R. *Learning Word Meanings: A Comparison of Instructional Procedures and Effects on Measures of Reading Comprehension with Learning Disabled Students,* March 1977. (ERIC Document Reproduction Service No. ED 136 237, 34p., HC-$2.06, MF-$.83)

No. 26: Armbruster, B. B., Stevens, R. J., & Rosenshine, B. *Analyzing Content Coverage and Emphasis: A Study of Three Curricula and Two Tests,* March 1977. (ERIC Document Reproduction Service No. ED 136 238, 22p., HC-$1.67, MF-$.83)

No. 27: Ortony, A., Reynolds, R. E., & Arter, J. A. *Metaphor: Theoretical and Empirical Research,* March 1977. (ERIC Document Reproduction Service No. ED 137 752, 63p., HC-$3.50, MF-$.83)

No. 28: Ortony, A. *Remembering and Understanding Jabberwocky and Small-Talk,* March 1977. (ERIC Document Reproduction Service No. ED 137 753, 36p., HC-$2.06, MF-$.83)

No. 29: Schallert, D. L., Kleiman, G. M., & Rubin, A. D. *Analysis of Differences between Oral and Written Language,* April 1977. (ERIC Document Reproduction Service No. ED 144 038, 33p., HC-$2.06, MF-$.83)

No. 30: Goetz, E. T., & Osborn, J. *Procedures for Sampling Texts and Tasks in Kindergarten through Eighth Grade,* April 1977. (ERIC Document Reproduction Service No. ED 146 565, 80p., HC-$4.67, MF-$.83)

No. 31: Nash-Webber, B. *Anaphora: A Cross-Disciplinary Survey,* April 1977. (ERIC Document Reproduction Service No. ED 144 039, 43p., HC-$2.06, MF-$.83)

No. 32: Adams, M. J., & Collins, A. *A Schema-Theoretic View of Reading Comprehension,* April 1977. (ERIC Document Reproduction Service No. ED 142 971, 49p., HC-$2.06, MF-$.83)

No. 33: Huggins, A. W. F. *Syntactic Aspects of Reading Comprehension,* April 1977. (ERIC Document Reproduction Service No. ED 142 972, 68p., HC-$3.50, MF-$.83)

No. 34: Bruce, B. C. *Plans and Social Actions,* April 1977. (ERIC Document Reproduction Service No. ED 149 328, 45p., HC-$2.06, MF-$.83)

No. 35: Rubin, A. D. *Comprehension Processes in Oral and Written Language,* April 1977. (ERIC Document Reproduction Service No. ED 150 550, 61p., HC-$3.50, MF-$.83)

No. 36: Nash-Webber, B., & Reiter, R. *Anaphora and Logical Form: On Formal Meaning Representation for Natural Language,* April 1977. (ERIC Document Reproduction Service No. ED 142 973, 42p., HC-$2.06, MF-$.83)

No. 37: Adams, M. J. *Failures to Comprehend and Levels of Processing in Reading,* April 1977. (ERIC Document Reproduction Service No. ED 145 410, 51p., HC-$3.50, MF-$.83)

No. 38: Woods, W. A. *Multiple Theory Formation in High-Level Perception,* April 1977. (ERIC Document Reproduction Service No. ED 144 020, 58p., HC-$3.50, MF-$.83)

No. 40: Collins, A., Brown, J. S., & Larkin, K. M. *Inference in Text Understanding,* December 1977. (ERIC Document Reproduction Service No. ED 150 547, 48p., HC-$2.06, MF-$.83)

No. 41: Anderson, R. C., & Pichert, J. W. *Recall of Previously Unrecallable Information Following a Shift in Perspective,* April 1977. (ERIC Document Reproduction Service No. ED 142 974, 37p., HC-$2.06, MF-$.83)

No. 42: Mason, J., Osborn, J., & Rosenshine, B. *A Consideration of Skill Hierarchy Approaches to the Teaching of Reading,* December 1977. (ERIC Document Reproduction Service No. ED 150 549, 176p., HC-$10.03, MF-$.83)

No. 43: Collins, A., Brown, A. L., Morgan, J. L., & Brewer, W. F. *The Analysis of Reading Tasks and Texts,* April 1977. (ERIC Document Reproduction Service No. ED 145 404, 96p., HC-$4.67, MF-$.83)

No. 44: McClure, E. ***Aspects of Code-Switching in the Discourse of Bilingual Mexican-American Children,*** April 1977. (ERIC Document Reproduction Service No. ED 142 975, 38p., HC-$2.06, MF-$.83)

No. 45: Schwartz, R. M. ***Relation of Context Utilization and Orthographic Automaticity in Word Identification,*** May 1977. (ERIC Document Reproduction Service No. ED 137 762, 27p., HC-$2.06, MF-$.83)

No. 46: Anderson, R. C., Stevens, K. C., Shifrin, Z., & Osborn, J. ***Instantiation of Word Meanings in Children,*** May 1977. (ERIC Document Reproduction Service No. ED 142 976, 22p., HC-$1.67, MF-$.83)

No. 47: Brown, A. L. ***Knowing When, Where, and How to Remember: A Problem of Metacognition,*** June 1977. (ERIC Document Reproduction Service No. ED 146 562, 152p., HC-$8.69, MF-$.83)

No. 48: Brown, A. L., & DeLoache, J. S. ***Skills, Plans, and Self-Regulation,*** July 1977. (ERIC Document Reproduction Service No. ED 144 040, 66p., HC-$3.50, MF-$.83)

No. 49: Goetz, E. T. ***Inferences in the Comprehension of and Memory for Text,*** July 1977. (ERIC Document Reproduction Service No. ED 150 548, 97p., HC-$4.67, MF-$.83)

No. 50: Anderson, R. C. ***Schema-Directed Processes in Language Comprehension,*** July 1977. (ERIC Document Reproduction Service No. ED 142 977, 33p., HC-$2.06, MF-$.83)

No. 51: Brown, A. L. ***Theories of Memory and the Problems of Development: Activity, Growth, and Knowledge,*** July 1977. (ERIC Document Reproduction Service No. ED 144 041, 59p., HC-$3.50, MF-$.83)

No. 52: Morgan, J. L. ***Two Types of Convention in Indirect Speech Acts,*** July 1977. (ERIC Document Reproduction Service No. ED 145 405, 40p., HC-$2.06, MF-$.83)

No. 53: Brown, A. L., Smiley, S. S., & Lawton, S. C. ***The Effects of Experience on the Selection of Suitable Retrieval Cues for Studying from Prose Passages,*** July 1977. (ERIC Document Reproduction Service No. ED 144 042, 30p., HC-$2.06, MF-$.83)

No. 54: Fleisher, L. S., & Jenkins, J. R. ***Effects of Contextualized and Decontextualized Practice Conditions on Word Recognition,*** July 1977. (ERIC Document Reproduction Service No. ED 144 043, 37p., HC-$2.06, MF-$.83)

No. 55: Jenkins, J. R., & Larson, K. ***Evaluating Error Correction Procedures for Oral Reading,*** June 1978. (ERIC Document Reproduction Service No. ED 158 224, 34p., HC-$2.06, MF-$.83)

No. 56: Anderson, T. H., Standiford, S. N., & Alessi, S. M. ***Computer Assisted Problem Solving in an Introductory Statistics Course,*** August 1977. (ERIC Document Reproduction Service No. ED 146 563, 26p., HC-$2.06, MF-$.83)

No. 57: Barnitz, J. ***Interrelationship of Orthography and Phonological Structure in Learning to Read,*** August 1977. (ERIC Document Reproduction Service No. ED 150 546, 62p., HC-$3.50, MF-$.83)

No. 58: Mason, J. M. ***The Role of Strategy in Reading in the Mentally Retarded,*** September 1977. (ERIC Document Reproduction Service No. ED 145 406, 28p., HC-$2.06, MF-$.83)

No. 59: Mason, J. M. ***Reading Readiness: A Definition and Skills Hierarchy from Preschoolers' Developing Conceptions of Print,*** September 1977. (ERIC Document Reproduction Service No. ED 145 403, 57p., HC-$3.50, MF-$.83)

No. 60: Spiro, R. J., & Esposito, J. J. ***Superficial Processing of Explicit Inferences in Text,*** December 1977. (ERIC Document Reproduction Service No. ED 150 545, 27p., HC-$2.06, MF-$.83)

No. 65: Brewer, W. F. ***Memory for the Pragmatic Implications of Sentences,*** October 1977. (ERIC Document Reproduction Service No. ED 146 564, 27p., HC-$2.06, MF-$.83)

No. 66: Brown, A. L., & Smiley, S. S. ***The Development of Strategies for Study Prose Passages,*** October 1977. (ERIC Document Reproduction Service No. ED 145 371, 59p., HC-$3.50, MF-$.83)

No. 68: Stein, N. L., & Nezworski, T. ***The Effects of Organization and Instructional Set on Story Memory,*** January 1978. (ERIC Document Reproduction Service No. ED 149 327, 41p., HC-$2.06, MF-$.83)

No. 69: Stein, N. L. ***How Children Understand Stories: A Developmental Analysis,*** March 1978. (ERIC Document Reproduction Service No. ED 153 205, 68p., HC-$3.50, MF-$.83)

No. 76: Thieman, T. J., & Brown, A. L. ***The Effects of Semantic and Formal Similarity on Recognition Memory for Sentences in Children,*** November 1977. (ERIC Document Reproduction Service No. ED 150 551, 26p., HC-$2.06, MF-$.83)

No. 77: Nash-Webber, B. L. ***Inferences in an Approach to Discourse Anaphora,*** January 1978. (ERIC Document Reproduction Service No. ED 150 552, 30p., HC-$2.06, MF-$.83)

No. 78: Gentner, D. ***On Relational Meaning: The Acquisition of Verb Meaning,*** December 1977. (ERIC Document Reproduction Service No. ED 149 325, 46p., HC-$2.06, MF-$.83)

No. 79: Royer, J. M. ***Theories of Learning Transfer,*** January 1978. (ERIC Document Reproduction Service No. ED 149 326, 55p., HC-$3.50, MF-$.83)

No. 80: Arter, J. A., & Jenkins, J. R. *Differential Diagnosis-Prescriptive Teaching: A Critical Appraisal,* January 1978. (ERIC Document Reproduction Service No. ED 150 578, 104p., HC-$6.01, MF-$.83)

No. 81: Shoben, E. J. *Choosing a Model of Sentence Picture Comparisons: A Reply to Catlin and Jones,* February 1978. (ERIC Document Reproduction Service No. ED 150 577, 30p., HC-$2.06, MF-$.83)

No. 82: Steffensen, M. S. *Bereiter and Engelmann Reconsidered: The Evidence from Children Acquiring Black English Vernacular,* March 1978. (ERIC Document Reproduction Service No. ED 153 204, 31p., HC-$2.06, MF-$.83)

No. 83: Reynolds, R. E., Standiford, S. N., & Anderson, R. C. *Distribution of Reading Time When Questions are Asked about a Restricted Category of Text Information,* April 1978. (ERIC Document Reproduction Service No. ED 153 206, 34p., HC-$2.06, MF-$.83)

No. 84: Baker, L. *Processing Temporal Relationships in Simple Stories: Effects of Input Sequence,* April 1978. (ERIC Document Reproduction Service No. ED 157 016, 54p., HC-$3.50, MF-$.83)

No. 85: Mason, J. M., Knisely, E., & Kendall, J. *Effects of Polysemous Words on Sentence Comprehension,* May 1978. (ERIC Document Reproduction Service No. ED 157 015, 34p., HC-$2.06, MF-$.83)

No. 86: Anderson, T. H., Wardrop, J. L., Hively W., Muller, K. E., Anderson, R. I., Hastings, C. N., & Fredericksen, J. *Development and Trial of a Model for Developing Domain Referenced Tests of Reading Comprehension,* May 1978. (ERIC Document Reproduction Service No. ED 157 036, 69p., HC-$3.50, MF-$.83)

No. 87: Andre, M. E. D. A., & Anderson, T. H. *The Development and Evaluation of a Self-Questioning Study Technique,* June 1978. (ERIC Document Reproduction Service No. ED 157 037, 37p., HC-$2.06, MF-$.83)

No. 88: Bruce, B. C., & Newman, D. *Interacting Plans,* June 1978. (ERIC Document Reproduction Service No. ED 157 038, 100p., HC-$4.67, MF-$.83)

No. 89: Bruce, B. C., Collins, A., Rubin, A. D., & Gentner, D. *A Cognitive Science Approach to Writing,* June 1978. (ERIC Document Reproduction Service No. ED 157 039, 57p., HC-$3.50, MF-$.83)

No. 90: Asher, S. R. *Referential Communication,* June 1978. (ERIC Document Reproduction Service No. ED 159 597, 71p., HC-$3.50, MF-$.83)

No. 91: Royer, J. M., & Cunningham, D. J. *On the Theory and Measurement of Reading Comprehension,* June 1978. (ERIC Document Reproduction Service No. ED 157 040, 63p., HC-$3.50, MF-$.83)

No. 92: Mason, J. M., Kendall, J. R. *Facilitating Reading Comprehension Through Text Structure Manipulation,* June 1978. (ERIC Document Reproduction Service No. ED 157 041, 36p., HC-$2.06, MF-$.83)

No. 93: Ortony, A., Schallert, D. L., Reynolds, R. E., & Antos, S. J. *Interpreting Metaphors and Idioms: Some Effects of Context on Comprehension,* July 1978. (ERIC Document Reproduction Service No. ED 157 042, 41p., HC-$2.06, MF-$.83)

No. 94: Brown, A. L., Campione, J. C., & Barclay, C. R. *Training Self-Checking Routines for Estimating Test Readiness: Generalization from List Learning to Prose Recall,* July 1978. (ERIC Document Reproduction Service No. ED 158 226, 41p., HC-$2.06, MF-$.83)

No. 95: Reichman, R. *Conversational Coherency,* July 1978. (ERIC Document Reproduction Service No. ED 159 658, 86p., HC-$4.67, MF-$.83)

No. 96: Wigfield, A., & Asher, S. R. *Age Differences in Children's Referential Communication Performance: An Investigation of Task Effects,* July 1978. (ERIC Document Reproduction Service No. ED 159 659, 31p., HC-$2.06, MF-$.83)

No. 97: Steffensen, M. S., Jogdeo, C., & Anderson, R. C. *A Cross-Cultural Perspective on Reading Comprehension,* July 1978. (ERIC Document Reproduction Service No. ED 159 660, 41p., HC-$2.06, MF-$.83)

No. 98: Green, G. M. *Discourse Functions of Inversion Construction,* July 1978. (ERIC Document Reproduction Service No. ED 160 998, 42p., HC-$2.06, MF-$.83)

No. 99: Asher, S. R. *Influence of Topic Interest on Black Children and White Children's Reading Comprehension,* July 1978. (ERIC Document Reproduction Service No. ED 159 661, 35p., HC-$2.06, MF-$.83)

No. 100: Jenkins, J. R., Pany, D., & Schreck, J. *Vocabulary and Reading Comprehension: Instructional Effects,* August 1978. (ERIC Document Reproduction Service No. ED 160 999, 50p., HC-$2.06, MF-$.83)

No. 101: Shoben, E. J., Rips, L. J., & Smith, E. E. *Issues in Semantic Memory: A Response to Glass and Holyoak,* August 1978. (ERIC Document Reproduction Service No. ED 159 662, 85p., HC-$4.67, MF-$.83)

No. 102: Baker, L., & Stein, N. L. *The Development of Prose Comprehension Skills*, September 1978. (ERIC Document Reproduction Service No. ED 159 663, 69p., HC-$3.50, MF-$.83)

No. 103: Fleisher, L. S., Jenkins, J. R., & Pany, D. *Effects on Poor Readers' Comprehension of Training in Rapid Decoding*, September 1978. (ERIC Document Reproduction Service No. ED 159 664, 39p., HC-$2.06, MF-$.83)

No. 104: Anderson, T. H. *Study Skills and Learning Strategies*, September 1978. (ERIC Document Reproduction Service No. ED 161 000, 41p., HC-$2.06, MF-$.83)

No. 105: Ortony, A. *Beyond Literal Similarity*, October 1978.

No. 106: Durkin, D. *What Classroom Observations Reveal about Reading Comprehension Instruction*, October 1978. (ERIC Document Reproduction Service No. ED 162 259, 94p., HC-$4.67, MF-$.83)

No. 107: Adams, M. J. *Models of Word Recognition*, October 1978. (ERIC Document Reproduction Service No. ED 163 431, 93p., HC-$4.67, MF-$.83)

No. 108: Reder, L. M. *Comprehension and Retention of Prose: A Literature Review*, November 1978.

No. 109: Wardrop, J. L., Anderson, T. H., Hively, W., Anderson, R. I., Hastings, C. N., & Muller, K. E. *A Framework for Analyzing Reading Test Characteristics*, December 1978.

No. 110: Tirre, W. C., Manelis, L., & Leicht, K. L. *The Effects of Imaginal and Verbal Strategies on Prose Comprehension in Adults*, December 1978.

No. 111: Spiro, R. J., & Tirre, W. C. *Individual Differences in Schema Utilization During Discourse Processing*, January 1979.

No. 112: Ortony, A. *Some Psycholinguistic Aspects of Metaphor*, January 1979.

No. 113: Antos, S. J. *Processing Facilitation in a Lexical Decision Task*, January 1979.

No. 114: Gentner D. *Semantic Integration at the Level of Verb Meaning*, February 1979.

No. 115: Gearhart, M., & Hall, W. S. *Internal State Words: Cultural and Situational Variation in Vocabulary Usage*, February 1979.

No. 116: Pearson, P. D., Hansen, J., & Gordon, C. *The Effect of Background Knowledge on Young Children's Comprehension of Explicit and Implicit Information*, March 1979.

No. 117: Barnitz, J. G. *Reading Comprehension of Pronoun-Referent Structures by Children in Grades Two, Four, and Six*, March 1979.

No. 118: Nicholson, T., Pearson, P. D., & Dykstra, R. *Effects of Embedded Anomalies and Oral Reading Errors on Children's Understanding of Stories*, March 1979.

No. 119: Anderson, R. C., Pichert, J. W., & Shirey, L. L. *Effects of the Reader's Schema at Different Points in Time*, April 1979.

No. 120: Canney, G., & Winograd, P. *Schemata for Reading and Reading Comprehension Performance*, April 1979.

No. 121: Hall, W. S., & Guthrie, L. F. *On the Dialect Question and Reading*, May 1979.

No. 122: McClure, E., Mason, J., & Barnitz, J. *Story Structure and Age Effects on Children's Ability to Sequence Stories*, May 1979.

No. 123: Kleiman, G. M., Winograd, P. N., & Humphrey, M. M. *Prosody and Children's Parsing of Sentences*, May 1979.

No. 124: Spiro, R. J. *Etiology of Reading Comprehension Style*, May 1979.

No. 125: Hall, W. S., & Tirre, W. C. *The Communicative Environment of Young Children: Social Class, Ethnic, and Situational Differences*, May 1979.

No. 126: Mason, J., & McCormick, C. *Testing the Development of Reading and Linguistic Awareness*, May 1979.

No. 127: Brown, A. L., & Campione, J. C. *Permissible Inferences from the Outcome of Training Studies in Cognitive Development Research*, May 1979.